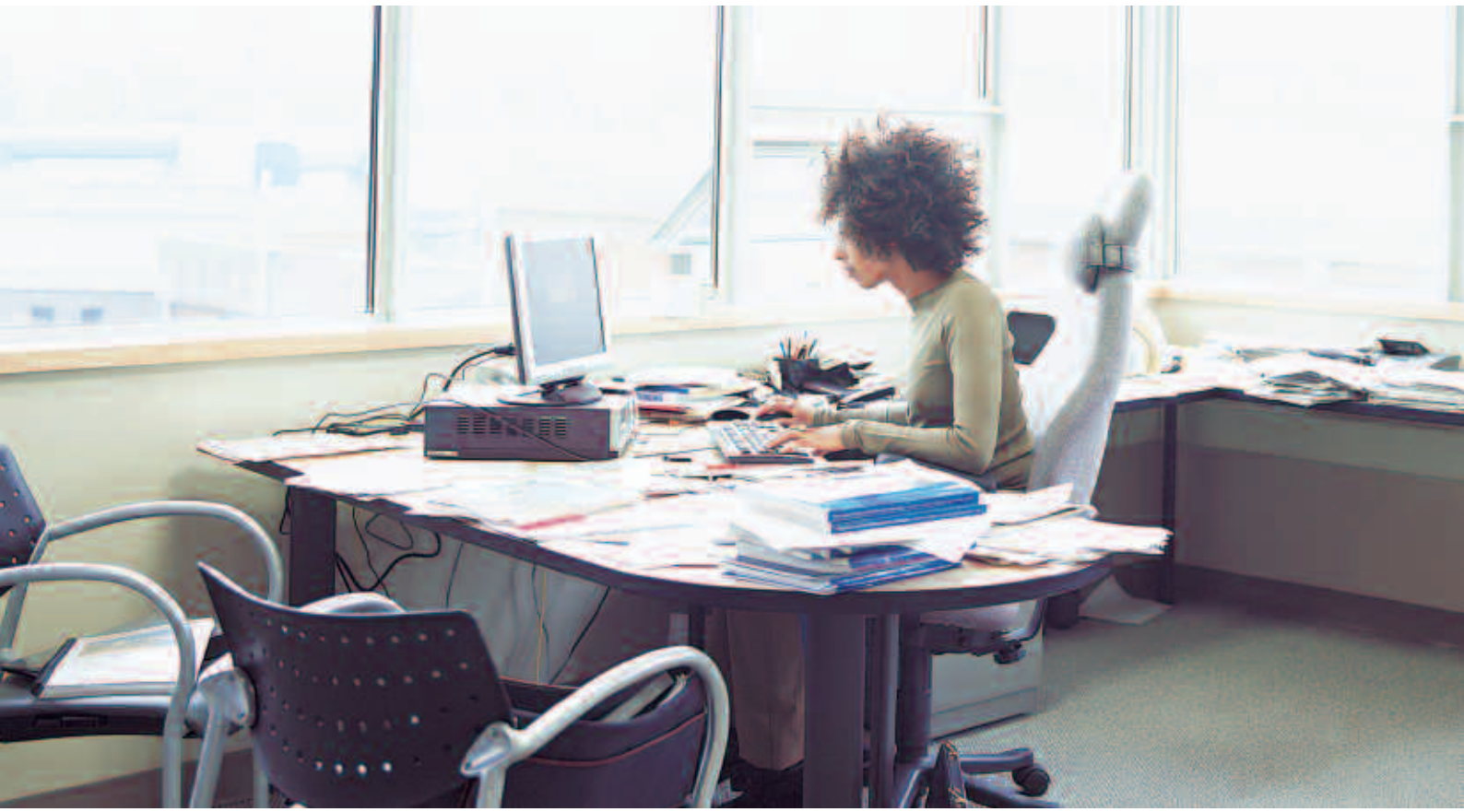
# Alcatel-Lucent 7750
# Service Router

The Alcatel-Lucent 7750 Service Router (SR) is the industry's first service router designed and optimized for the delivery of high-performance carrier data, voice and video services. The Alcatel-Lucent 7750 Service Router was designed with system characteristics, routing and service capabilities that have made it the platform of choice in more than 50 new-generation service infrastructure rollouts.



# The Changing Service Landscape — Rethinking the Service Delivery Architecture

The Alcatel-Lucent 7750 SR functions as both a powerful router and a flexible service delivery platform, and integrates with the Alcatel-Lucent 5620 Service Aware Manager (SAM) to deliver efficient and streamlined provisioning, management and billing for Internet protocol (IP)/multiprotocol label switching (MPLS) networks.

Global service providers are preparing for the next wave of residential and business service deployments. They understand that in order to be successful they need a service delivery infrastructure that offers more bandwidth, delivered flexibly and reliably to more customers simultaneously, with increased service level guarantees.

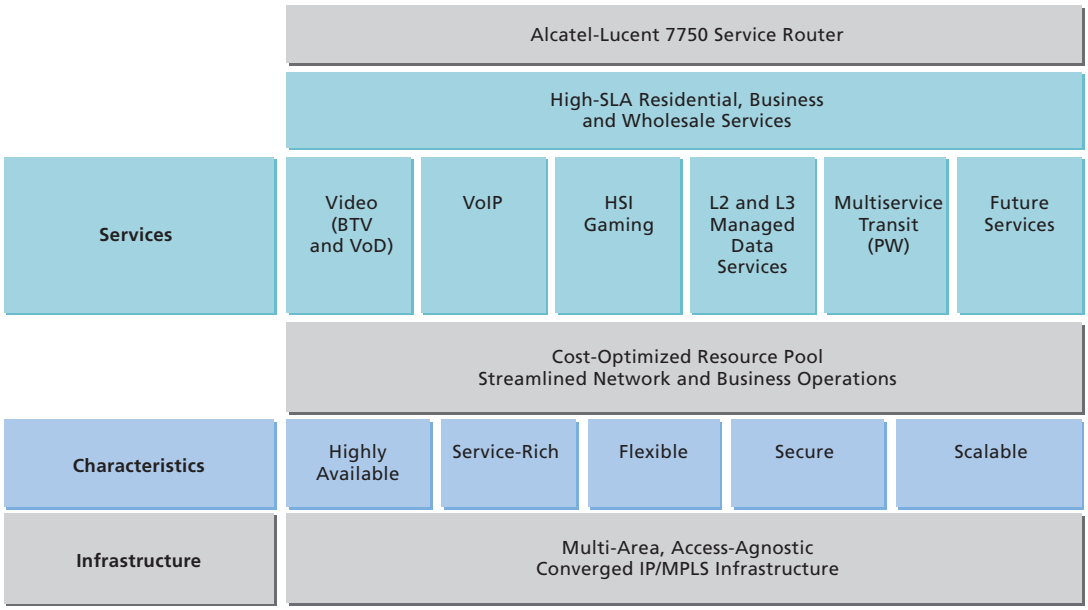
Service providers are increasingly called upon to offer personalized voice video and data services that recognize the unique needs of individual users; that are, in other words, more "user-centric." While the past few years have seen a focus on network and service convergence with an emphasis on killer applications delivered over a single infrastructure, the paradigm has shifted to a user-centric focus that embraces the demand for a customized and media-rich user experience across multiple access methods and across applications.

- For the residential market, the need to deliver broadcast TV and video-on-demand (VoD) services that meet high service level agreement (SLA) standards has introduced an inflection point that has pushed network service providers to profoundly rethink their service delivery architectures. High-speed Internet (HSI) infrastructures were built around inefficient business models that focused on cost-per-subscriber considerations and allowed for significant oversubscription and service level leniency. New high-SLA voice and video applications have very stringent availability, system characteristics, quality of service (QoS), multicast and service requirements. Those requirements can only be cost-effectively addressed by rethinking the overall service delivery infrastructure.

- In the enterprise space, new managed data services — such as virtual private LAN service (VPLS), IP virtual private networks (IP-VPNs) and multiservice transit applications using pseudowires (PWs) over a variety of access methods (frame relay [FR], asynchronous transfer mode [ATM], Ethernet, high-level data link control [HDLC]/point-to-point protocol [PPP], etc.) — allow service providers to attract and retain a wider customer base at a lower cost through converged and more reliable IP/MPLS service infrastructures. In turn, end-user customers benefit from a wider variety of service offerings, increased service flexibility and accelerated service activation.

With the Alcatel-Lucent 7750 SR, service providers are able to build a new type of cost-optimized highly-available and feature-rich service delivery infrastructure that can seamlessly scale to address both residential and managed data service market needs, while delivering significant economies of scale, skill and scope.

**Figure 1 - Rethinking the Service Delivery Architecture**



# A New Class of Platform

The Alcatel-Lucent 7750 SR platform provides purpose-built, highly available software and hardware architectures that allow network operators to "right-size" their service infrastructure buildout. The 7750 SR provides the necessary built-in services capabilities and packet processing headroom to allow service providers to scale service instances, subscriber count and bandwidth without incurring exponential capital or operating expenditures (CAPEX or OPEX).

The critical features and functions that differentiate the Alcatel-Lucent 7750 SR from a typical Internet-era edge router are the system characteristics (delay/jitter) and service-related capabilities that were tightly integrated into the product architecture at inception.

The change from traditional best-effort Internet routing and enterprise switching to true service routing is not an incremental step — it is a radical advancement that has required a complete rethinking of the product architecture and design at inception. This inflection point is where the Alcatel-Lucent 7750 SR has established a leadership position.

## An Industry First

The challenges that service providers are facing have evolved from addressing rampant bandwidth growth for Internet traffic to enabling cost-optimized and highly resilient service delivery infrastructures that can scale and ensure profitability while minimizing the overall deployment risk in the long run.

Existing Internet-era routers and enterprise switches were designed five to eight years ago to handle bandwidth growth for best-effort traffic. These platforms were not optimized for new-generation service infrastructure rollouts, as they are limited by their system characteristics (delay/jitter, packet re-ordering and loss) and their inability to scale services across all dimensions (number of interfaces, bandwidth, service instances and policies, performance level, etc.).

Similarly, so-called IP service platforms have appeared on the market, but they were designed and optimized for low-speed, best-effort consumer services (mass-market digital subscriber line [DSL] for residential service). They do not have the high-availability, scalability or service capabilities that will allow them to cost-effectively enable large-scale (tens of millions of customers), high-speed data, voice and video service rollouts.

# The Profitability Factor

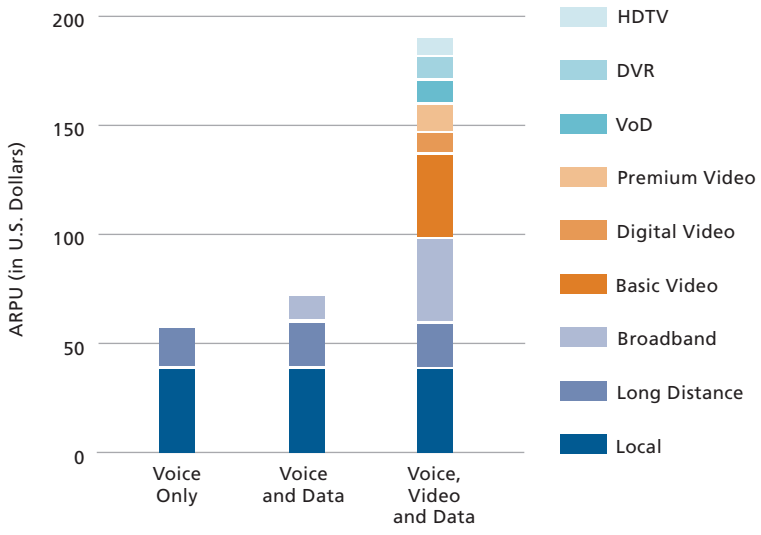
An improved regulatory environment and the clear potential for incremental revenue have convinced many incumbent service providers to rapidly make considerable investments in new service delivery infrastructures. By adding video, voice and managed data services to their existing high-speed data and Internet service lineups, service providers can improve their competitive position in the market.

All service providers competing in this market are faced with the challenging task of offering a compelling value proposition for their service offerings in order to achieve and maintain a high average revenue per user (ARPU) and to sustain the long-term profitability of their services (see Figure 2).

For service providers who successfully meet this challenge, benefits will include the ability to:

- Successfully sell new, higher value services to their established customer base
- Leverage their brand equity to offer high-margin bundles and minimize churn
- Progressively build their service infrastructures around profitability models, as opposed to network or infrastructure constraints
- Consolidate multiple specialized networks into a cost-optimized and efficient service infrastructure that will achieve economies of scale and maximize the profitability of services

**Figure 2 - Projected ARPU for Various Triple-Play Services**




Source: The Yankee Group, 2004

- Streamline network operations across protocol layers to achieve economies of skill, and evolve the overall service infrastructure to a more homogeneous, scalable and flexible architecture
- Streamline business operations to achieve significant economies of scope across service offerings (e.g., order fulfillment, support, billing, marketing)
- Future-proof their service infrastructures for the future layering of ultra-high bandwidth business and residential applications
- Minimize the overall financial and technological risks over the next seven to ten years

In order for service providers to achieve significant economies of scale, skill and scope they need to evolve their second-mile, and perhaps first–mile, infrastructures to a highly available, secure and cost-optimized service delivery foundation that can scale to support existing and future ultra-high-speed residential and business service rollouts. This requires a comprehensive approach to the service delivery architecture design.

The Alcatel-Lucent 7750 SR offers unmatched density and performance: up to 400 Gb/s full duplex redundant capacity in one-third of a carrier's system rack. This, along with its advanced service-oriented features, makes it the ideal choice for service providers who are looking to roll out a new generation of triple-play infrastructure-based services.

An important capability that distinguishes the Alcatel-Lucent 7750 SR from Internet-era routers is the built-in packet processing, service headroom and flexibility that ensures that new features can be soft-loaded with the promise of uncompromised performance up to 40 Gb/s per slot. Application-specific integrated circuit (ASIC)-based implementation, on the other hand, requires a costly and lengthy line card re-spin each time a new feature or extension is required. For the service provider this results in high cumulative CAPEX, disruption of service and slot exhaustion as each new feature and capability requires a new specialized line card or module. This approach lengthens time-to-market for services and introduces significant support and turnaround time.

"The Alcatel 7750 SR is a great example of a multiservice edge router. It not only combines the scalability that's required for these consolidated IP/MPLS networks, but it also incorporates a number of different features that help service providers deliver IP/MPLS-based services. That is really the distinguishing factor between the 7750, for example, and some other traditional edge routers on the market today. It makes it a great fit for those consolidated network environments."

MARK BIEBERICH, SENIOR ANALYST, COMMUNICATIONS NETWORK INFRASTRUCTURE, THE YANKEE GROUP

* This reference was provided to Alcatel prior to the merger.

# Key Features

The Alcatel-Lucent 7750 SR delivers the features that service providers need to offer a new generation of highly profitable media-rich services. The service orientation of the Alcatel-Lucent 7750 SR means that all the features are designed around the concept of a service, whereas existing routers and switches were designed around physical interfaces. This fundamental difference in architecture and design separates the Alcatel-Lucent 7750 SR from other vendors' routers.

**Table 1. The 7750 SR vs. Internet-era Routers**

| | Internet-era Router | Alcatel-Lucent 7750 SR |
|---|---|---|
| Architecture and system characteristics | Repurposed core router, positioned as edge platform<br><br>Architecture optimized for low fan-out "fat pipe" forwarding<br><br>ASIC-based architecture results in costly proliferation of specialized service modules: results in exponential CAPEX, slot exhaustion, and low feature velocity<br><br>Substandard, unpredictable delay/jitter and loss characteristics<br><br>Known packet re-ordering issues<br><br>Inadequate for media-rich voice and video deployments | Purpose-built portfolio<br><br>Highly-available hardware and software architecture built to exceed stringent SP requirements<br><br>Flexible Fast Path architecture combines high performance and flexibility<br><br>Scales service instances, subscriber count and bandwidth with uncompromised performance<br><br>Optimal delay/jitter characteristics<br><br>Density/flexibility in form factor |
| QoS | "Coarse" QoS implementation<br><br>Static QoS implementation, inadequate for voice and video applications<br><br>Low queue count results in queue depletion and forced costly upgrade to enhanced line cards | Unique hierarchical QoS capabilities are ideally suited for triple-play deployment<br><br>Highly scalable QoS implementation scales to tens of thousands of subscribers: 16,000+ queues available per interface slot |
| Routing | Good support<br><br>No high-availability routing | Leading high-availability routing capabilities<br><br>Leading all-around routing scalability |
| Services | Service deployments result in costly service module proliferation: maximized cumulative CAPEX<br><br>Cannot scale services across all dimensions without forced compromise<br><br>Cannot scale Layer 2 and Layer 3 services concurrently<br><br>Non-scalable proprietary VPLS implementation | Leading service scale<br><br>Unique ability to scale Layer 2 and Layer 3 services within one platform: 11,000+ concurrent active service instances per chassis<br><br>Flexible Fast Path architecture scales service instances, subscriber count and bandwidth with uncompromised performance |

## Purpose-Built, Highly-Available Platforms

The Alcatel-Lucent 7750 Service Router portfolio benefits from Alcatel-Lucent's recognized experience in delivering carrier-grade telephony, wireless, optical and data solutions. The Alcatel-Lucent 7750 SR portfolio was designed to exceed the stringent reliability demands of service providers, with a hardware and software architecture designed for maximum uptime.

The Alcatel-Lucent 7750 SR is a fully redundant platform with no single point of failure, and implements a real-time, modular operating system that has been proven and production-hardened in more than 50 large-scale deployments worldwide.

## Rich, Dependable Services

The 7750 SR portfolio allows service providers to deploy and scale a rich set of high-SLA services, without the need for costly line card or platform proliferation.

The system characteristics, service performance and QoS capabilities of the 7750 SR have made it the platform of choice for media-rich, triple-play deployments.

Additionally, the Alcatel-Lucent 7750 SR provides a leading implementation of point-to-point and multipoint IP/MPLS services. The services enabled are pseudowires for multiservice transit over IP/MPLS, VPLS, corporate Internet access, IP-VPNs and more.

The Alcatel-Lucent 7750 Service Router's built-in system characteristics, flexibility and service capabilities allow service providers to activate a new generation of high-performance data services, including carrier voice and video services. The Alcatel-Lucent 7750 SR's unique packet processing and hierarchical QoS (H-QoS) capabilities have made it the platform of choice for a new generation of triple-play service infrastructure rollouts.

## Market-Leading Scalability

The Alcatel-Lucent 7750 SR was designed to support tens of thousands of services per device and scale to hundreds of thousands of service instances per service area, making it ideal for multiservice edge and collapsed core applications. Each individual service can be configured with thousands of specific ingress and egress QoS parameters and multiple services can be aggregated to deliver a single, overall SLA to each customer. Granular service-oriented accounting and statistics scale to enable accurate SLA measurement and billing for tens of thousands of high-bandwidth subscribers.

## Flexible Service Evolution

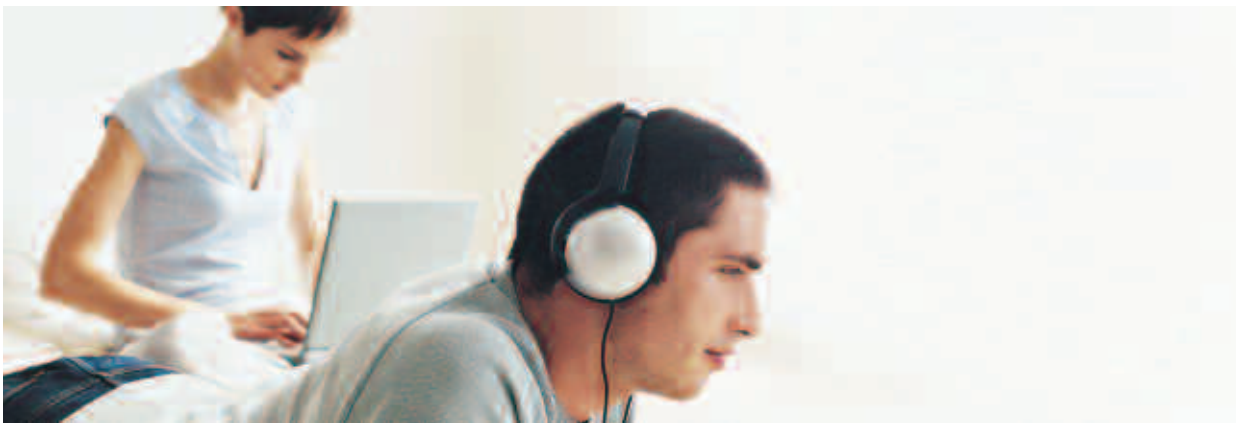
The unique, fully programmable network processor-based architecture of the Alcatel-Lucent 7750 SR allows service providers to customize or add new services and adapt to emerging standards with simple in-service downloads, without requiring expensive and lengthy hardware upgrades. Service providers can roll out new services faster, to more customers, at a lower operational cost, all through a common network infrastructure.

## All Services on All Interfaces

All service features such as QoS, deep buffering, rate shaping, traffic marking and billing are available on all interfaces or sub-interfaces. Service providers can provision access ports and IP or MPLS tunnels on any physical interface, with no additional specialized hardware required.

## Service-Based Hierarchical QoS

With the Alcatel-Lucent 7750 SR service providers can offer voice, video or VPLS and IP-VPN services on an unprecedented scale to thousands of customers with guaranteed QoS differentiation. Service providers can give distinctive treatment to individual services, and combine multiple service classes for any customer into a single SLA with committed information rate (CIR) and peak information rate (PIR) guarantees.



## Service-Based Accounting

Instead of maintaining statistics on a per-port basis, the Alcatel-Lucent 7750 SR keeps statistics on a billable service basis, providing accurate measurement of each customer's traffic and each individual service's conformance to the offered SLA.

## Service-Based Filtering

The Flexible Fast Path technology of the Alcatel-Lucent 7750 SR enables service providers to define and apply complex filters without performance impact, providing high levels of security and troubleshooting on a per-service basis, even at 10 Gb/s speeds. Global templates allow complex functions to be defined once and applied to individual ports or services as required.

## Service-Aware Operational Toolkit

A key feature of the Alcatel-Lucent 7750 SR is its comprehensive set of service-aware tools that allow efficient operation, administration, maintenance and provisioning (OAM&P) of IP/MPLS networks and, more importantly, services.

The Alcatel-Lucent 7750 SR supports a variety of protocols and custom-designed tools to help service providers verify correct operation on a per-service basis and troubleshoot individual services should an issue arise, without the need for complex scripting and command line debugging of individual routers.

In addition to extensive service assurance and diagnostic tools, the Alcatel-Lucent 7750 SR supports a unique service mirroring function that mirrors traffic on a per-service or sub-interface basis, and re-encapsulates the mirrored data for transport through the core network. This enables an operator to see the actual traffic from any customer's service at a central network operations center, reducing

"The Alcatel 7750 SR is a new category of platform that exceeds the requirements we have developed with the help of service providers. We are comfortable validating the Alcatel 7750 SR's overall state-of-the-art routing and Layer 2 and Layer 3 service capabilities, and are confident the product will allow service providers to activate a new generation of high-performance IP-based services."

DR. BIJAN JABBARI, PRESIDENT OF ISOCORE

* This reference was provided to Alcatel prior to the merger.

truck rolls and the amount of operations equipment required, and allowing the most appropriate personnel and tools to be applied rapidly if problems arise.

## Service-Aware Management

The Alcatel-Lucent 5620 Service Aware Manager (SAM) is a tightly integrated suite of management applications that simplify the process of provisioning, monitoring and troubleshooting services on the Alcatel-Lucent 7750 Service Router. Together with the Alcatel-Lucent 5620 Network Manager (NM), the Alcatel-Lucent 7750 SR and the Alcatel-Lucent 5620 SAM form the industry's most comprehensive carrier-grade IP network resource and service management solution.

# Three Scalable Chassis Options — One Industry-Leading Solution

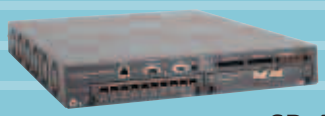
The Alcatel-Lucent 7750 SR delivers outstanding performance, flexibility and scalability across a range of services, leveraging a generational leap in technology compared to today's Internet routers. The Alcatel-Lucent 7750 SR has three chassis options: 12-slot, 7-slot and 1-slot. These chassis options incorporate the latest technology to offer carrier-class reliability and industry-leading throughput and density in an efficient, compact footprint.

## Modular Design

The modular chassis design scales from 20 Gb/s to 400 Gb/s (full-duplex) with a very small footprint, addressing a range of service applications from small points of presence (PoPs) to collapsed core applications. This ability to scale down services allows network operators to right-size their CAPEX investment, yet provides them with the necessary processing headroom that allows them to scale service instances, subscriber count and bandwidth without compromise.

Interchangeable I/O modules, media dependent adapters and a common operating system across all three platforms further reduce both capital and operating expenses.

**The common design features of the three chassis help to reduce capital and operating expenses.**



SR-1

SR-7

SR-12

# The Alcatel-Lucent Solution

Alcatel-Lucent offers a comprehensive portfolio of carrier-class products that enables a new type of highly available, feature-rich and scalable service delivery architecture. The Alcatel-Lucent 7750 SR is uniquely positioned to address the full range of service offerings that will allow service providers to increase network yields and maximize service profitability by offering managed data and triple-play offerings over a unified service infrastructure.

## Summary

Fuelled by the rapid growth in demand for new, high-value broadband services and the need to offer triple-play capabilities, telecommunications service providers are incorporating entertainment services with their broadband and managed data service portfolios.

As the demand for high-performance voice, video and managed data services continues to grow, a new generation of router is needed that incorporates the service-oriented features, flexibility, scalability and system characteristics required to deliver revenue and profit. The Alcatel-Lucent 7750 Service Router (SR) is this new-generation router. It offers fully programmable 10 Gb/s packet processing and hierarchical, granular per-service queuing. It delivers next-generation density and performance, unmatched scalability and comprehensive OAM&P management tools. The robust, cost-effective Alcatel-Lucent 7750 SR enables service providers to deliver offerings that expand their customer base and improve service velocity and loyalty in both their residential and enterprise markets.

With the Alcatel-Lucent 7750 SR, service providers can address two key inflection points and unlock new revenue potential by delivering end-to-end and user-centric managed data and broadband entertainment solutions over a unified service delivery architecture.

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